

Appendix G | Resources

There are perhaps hundreds of resources designed to help transportation professionals develop safe, functional and attractive bicycling facilities. The following resources are considered to be essential starting points for work in this area. Links to additional resources can be found at www.mtc.ca.gov/planning/bicycles/pedestrians. Following this list are descriptions of and links to tools that can help bicycle planners and traffic engineers develop better bicycle facilities.

Manual on Uniform Traffic Control Devices

“The Manual on Uniform Traffic Control Devices, or MUTCD, defines the standards used by road managers nationwide to install and maintain traffic control devices on all streets and

highways. The MUTCD is published by the Federal Highway Administration (FHWA) under 23 Code of Federal Regulations (CFR), Part 655, Subpart F.” – Federal Highway Administration

The first volume of the MUTCD was published in 1932 in response to the proliferation of transportation infrastructure following the introduction of the “horseless carriage” in the late 19th century. Today, state and local transportation practitioners who design roadways and other facilities use the MUTCD as the foremost authority on signing and marking. In the 75 years since its first publication, there have been nine editions of the MUTCD, with the next edition scheduled for release in 2009. Local agencies can request permission to

experiment with new markings or traffic controls that are not currently in the MUTCD. FHWA outlines a process for experimentation and for amending the document.

The National Committee on Uniform Traffic Control Devices (NCUTCD) is a private organization with no official affiliation with the Federal government. Committee members meet semiannually to discuss the MUTCD and to develop consensus comments and recommendations, which are then submitted to the FHWA for consideration. Currently, NCUTCD membership includes more than 200 traffic control device experts, representing a wide variety of organizations with an interest in

and experience with traffic control device issues.

Standards for bicycle facilities are covered in Part 9 of the MUTCD. For more information, frequently asked questions, an electronic version of the MUTCD, and a list of upcoming changes, visit:

<http://mutcd.fhwa.dot.gov>

California's Manual on Uniform Traffic Control Devices

"As of September 26, 2006, the California Department of Transportation adopted the California Manual on Uniform Traffic Control Devices (FHWA's MUTCD 2003 Revision 1, as amended for use in California), also called the California MUTCD, to prescribe uniform standards and specifications for all official traffic control devices in California."

— Caltrans

California's MUTCD consists of the federal MUTCD plus a California Supplement, which makes the document consistent with Chapter 1000 of the Caltrans *Highway Design Manual* (see below) and provides additional standards with respect to signage.

Highway Design Manual

"The needs of nonmotorized transportation are an essential part of all highway projects...Chapter 1000 of the Highway Design Manual discusses bicycle travel. All city, county, regional and other local agencies responsible for bikeways or roads where bicycle travel is permitted must follow the minimum bicycle planning and design criteria contained in this and other chapters of this manual (see Streets and Highways Code Section 891)."

— Caltrans

The California Department of Transportation, or Caltrans, publishes the Highway Design Manual (HDM), which governs the design of transportation facilities throughout the State. Chapter 1000 provides detailed information about signing and marking for on-street and off-street bicycle facilities. The HDM is not intended to provide best practices; rather, it provides minimum design standards for commonly used bicycle facilities such as bicycle lanes.

www.dot.ca.gov/hq

A Policy on Geometric Design of Highways and Streets, 5th Edition (aka the "Green Book")

"The American Association of State Highway and Transportation Officials (AASHTO) advocates transportation-related policies and provides technical services to support states in their efforts to efficiently and safely move people and goods." — AASHTO

AASHTO publishes a series of documents related to planning, operations, and design of transportation facilities. The most prominent publication, *A Policy on Geometric Design of Highways and Streets, 5th Edition*, is also known as the "Green Book" because of its signature color. The "Green Book" contains the latest design practices in universal use as the standard for highway geometric design.

<https://bookstore.transportation.org>

Guide for the Development of Bicycle Facilities

"Bicycle travel has played an historic role in transportation. Even before the invention of the automobile, the League of American Wheelmen promoted improved traveled ways"—American

Association of State Highway and Transportation Officials

This guide provides information on the development of new facilities to enhance and encourage safe bicycle travel, including planning considerations, design and construction guidelines, and operation and maintenance recommendations. The document culls relevant design guidelines from AASHTO's "Green Book," and includes more robust explanations of special considerations when planning for cyclists. The guide is currently under revision; the new version is expected to become available in early 2009.

http://downloads.transportation.org/aashto_catalog.pdf

Pedestrian and Bicycle Information Center (PBIC)

"Since its inception in 1999, PBIC's mission has been to improve the quality of life in communities through the increase of safe walking and bicycling as a viable means of transportation and physical activity. The PBIC is managed and operated by staff at the University of North Carolina Highway Safety Research Center, including engineers, urban

planners, public health specialists, Web site specialists, researchers, computer programmers, communication specialists, and others." – PBIC

The Pedestrian and Bicycle Information Center is the clearinghouse for accurate and current bicycling and pedestrian information. The bicycle pages of the PBIC Web site provide information on the latest research, new tools (such as the Cost/Benefit Analysis Tool for new bicycle facilities discussed later in this appendix), and examples of exemplary bicycle plans. The site is useful to a variety of audiences, including practitioners at every level, advocates, interested community members, and academics.

www.bicyclinginfo.org

Innovative Bicycle Treatments

"The intent of this report is to identify bicycle and pedestrian facility innovations and to share information on their applications, advantages and disadvantages; this report does not necessarily encourage or discourage their use"
— Institute of Transportation Engineers (ITE)

This report, developed by the ITE Pedestrian and Bicycle Council, provides information on approximately 50 bicycle treatments, including on-street innovations such as contra-flow bike lanes, bicycle boulevards, and colored bike lanes, as well as trail facilities. The report includes sections on bicycles at intersections, bicycle detection, unique bicycle signs, traffic calming accommodations and bicycle parking. The description of each innovation is accompanied by graphics, applications, advantages/disadvantages, evaluation studies, sample sites and contact information for locations where the device is in use.

www.ite.org/bookstore

Local design guidelines

While the federal and State Manuals on Uniform Traffic Control Devices, the Caltrans Highway Design Manual and the AASHTO publications cited above provide information about planning and designing bicycle facilities, local agencies have also created excellent examples of design guidelines that identify best practices, rather than minimum standards. One of the most commonly cited guides is the Santa Clara

Valley Transportation Authority's extensive *Bicycle Technical Guidelines*. Another example of design guidelines that covers innovative tools is the *San Francisco Bicycle Plan Update: Supplemental Design Guidelines*, published in 2003.

- VTA Bicycle Technical Guidelines
www.sccrtc.org
- San Francisco Supplemental Design Guidelines
www.bicycle.sfgov.org

Tools

Shared-use path level of service (LOS) calculator

The 1999 American Association of State Highway and Transportation Officials (AASHTO) *Guide for the Development of Bicycle Facilities* (aka the "Green Book") states, "Under most conditions, a recommended paved width for a two-directional shared-use path is 3.0 m (10.0 feet). . . Under certain conditions it may be necessary or desirable to increase the width of a shared-use path to 3.6 m (12.0 feet) or even 4.2 m (14.0 feet), due to substantial use by bicycles, joggers, skaters and pedestrians." While the Green Book acknowledges that sometimes a wider path

is desirable, it does not provide direction on when and how to determine the appropriate width.



The shared-use path level of service calculator is a spreadsheet tool developed by the Federal Highway Administration (FHWA). It allows agencies to estimate demand for bicycle/pedestrian multiuse pathways, size new facilities and plan improvements to existing ones. The tool can also be used to determine the maximum number of users that existing trails can comfortably accommodate and to understand bicycle LOS at "pinch points."

The trail LOS model uses six levels of service categories represented by the letters A to F, from best to worst. This system is similar to motor vehicle LOS in the following ways:

- A key criterion is maintaining an optimum speed (for the bicyclist).
- Service measures are primarily related to freedom to maneuver. These include meetings, active passes, delayed passes, and the perceived ability to pass.
- Safety is not included in the set of measures that establish service levels.

The key difference between trail LOS and motor vehicle LOS is that trail LOS does not factor in travel time or traffic interruptions such as signals or stop signs at grade crossings.

Information necessary to run the calculator is trail width, one-way user volume, and mode split among five user types: bicyclists; pedestrians; in-line skaters; runners; and child bicyclists. (The tool is not meant for trails with users beyond these five user types, such as equestrians.) To use the LOS calculator, test segments must be a minimum of 0.25 miles long. There is no

maximum as long as width, striping, volume and mode split characteristics are consistent within the segment. The tool is meant only to apply to paved, hard surface, two-way shared-use paths with at-grade crossings no more than once every 0.25 miles. Although improvements to LOS are likely to benefit all users, the purpose of the tool is mainly to evaluate bicycle mobility.

To download the calculator:

www.tfhrc.gov/safety/pedbike/pubs/05138

Bicycle safety index

The intent of the *Pedestrian and Bicyclist Intersection Safety Indices*, published by the Federal Highway Administration (FHWA), is to establish a methodology that agencies can use to prioritize improvements to intersection crossings (for pedestrians) and approaches (for cyclists). The report does not establish a desirable (or undesirable) safety index value; rather, agencies can use the index to compare a group of locations to each other in order to determine which location performs the best according to the indices.

FHWA collected quantitative data in the form of conflicts and avoidance maneuvers and qualitative data in the form of expert safety ratings in order to formulate the index. The bicycle portion analyzed 67 intersection approaches from Gainesville, Fld.; Philadelphia, Penn.; and Portland and Eugene, Ore.



In the field, agencies using the tool collect data about variables such as presence of bicycle lanes, main and cross street traffic volumes, number of through and turn lanes, presence of on-street parking, main street speed limit, and presence of traffic signal. The *Pedestrian and Bicyclist Intersection Safety*

Indices are most appropriate for use in the following situations:

- three-leg and four-leg intersections;
- signalized, two-way and four-way stops;
- on streets with traffic volumes from 600 to 50,000 vehicles per day;
- on one-way and two-way roads;
- on streets with one to four through lanes; and
- on streets with speed limits from 15 to 45 miles per hour.

To download the document:

www.tfhrc.gov/safety/pedbike/pubs/06125/06125.pdf

Cost/benefit tool

This new online sketch-planning tool helps bicycle facility planners and designers project the relative costs and benefits of new facilities on a cost-per-user basis.

Developed by the Transportation Research Board (TRB), this tool is appropriate only for citywide sketch planning.

Tool users enter two types of information:

1. Factors that influence demand, including land-use density around the project, household size and income for the city in

which the facility will be built, and the length of the facility.

2. Facility cost. With this information, the tool projects: the range of potential cyclists that might use the facility; the “mobility savings” per trip made by bicycle on the facility; and the health benefits of the facility, in terms of dollars.

The TRB cost/benefit tool has been subject to very limited testing and, given the rough nature of the data required, is useful only at a big-picture level. For instance, while it takes land-use density and household size into consideration, the tool does not account for a mix of uses or proximity of destinations. Therefore, this tool may be useful to compare one project to another, but it has not yet proven sufficiently accurate to anticipate the actual cost/benefit ratio of a particular project.

Bicycle counters

Collecting data on the number of cyclists in a corridor can be time-consuming and expensive, as most counts are still taken manually. However, there are several techniques for counting cyclists that do not

require a human in the field, including the following:

- Infrared and laser counts require no on-site staff and compile data automatically; however, they only produce raw numbers, not user information such as age, experience, etc. These techniques work by registering each time a cyclist “breaks” the laser or passes through a given plane. Because they can’t distinguish between cyclists and pedestrians or motorists, these techniques are only recommended for trails where the only users are cyclists.
- Time-lapse video photographs a given location every few seconds, and allows counting to take place without a human present, but still relies on humans for analysis.
- In-pavement loop detectors, which were originally designed to allow traffic signals to detect motor vehicles, have recently been used to count bicyclists. These detectors can only detect bikes with some amount of metal in the frame and must be near a traffic signal box that

can collect data, which then requires extensive staff time for tabulation and analysis. Bay Area locations currently experimenting with in-pavement counters include San Francisco and Alameda County.

- Pyroelectric sensors detect body heat in both pedestrians and cyclists and are currently in use at U.C. Berkeley. These sensors are very new and have yet to be evaluated for accuracy or usefulness.